PERIODICAL ROOM
GENERAL LIBRARY
UNIV. OF MICH.

JUL 28

SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

A SCIENCE SERVICE PUBLICATION

$5 a year 15c a copy May 26, 1928

COSMIC DUST CLOUDS

Dark Matter in Ophiuchus

(See page 323)

Vol. XIII No. 372

Icy Wings Menace Distance Flights

Aviation

By Thomas Carroll

Mr. Carroll is chief test pilot for the National Advisory Committee for Aeronautics.

Man's conquest of the air has met many obstacles and from many unlooked for sources. The formation of ice on the wings and other parts of an airplane in flight is one which is engaging serious attention just now.

It is not a new phenomenon. It was definitely reported in the Air Mail seven years ago, but it has always been considered a freak consequence of freak conditions.

The conditions which provide the phenomenon are not understood. It is similar to the formation of sleet on trees but that does not by any means appear to be the whole story. Attempts at reproducing the ice condition in the laboratory have failed. Further mystery is supplied in the fact that it has not been reported except by American planes in North America.

The accumulation of ice, once it starts to form, becomes distributed over the front edges of the wings, of the struts and other parts. That it could form on the blades of the propellor running at fifteen hundred revolutions per minute has been scoffed at as an impossibility, but it is nevertheless a definitely established and recorded fact.

Ice is heavy and even a thin coating on an airplane can provide a considerable additional weight to overload the plane. But two other ways in which the ice forces the airplane down are of even greater detriment. As the ice forms it mushrooms out along the front edges and forms bulges and bumps along the forward part of the wings. In the first place this greatly increases the air resistance requiring more power to pull it through the air and in the second the proper shape of the wing contour which provides the lifting force is seriously interfered with. These, with the added weight of the ice, drive the plane lower and lower and finally force it to the ground.

Many remedies and preventives have been suggested and have been tried.

Most promising is the proposition to pipe the exhaust through the wings to keep them warm. This may be effective since it is believed that only a small rise in temperature will prevent the ice.

Science News-Letter, May 26, 1928

Cancer Waste

Medicine

Cancer costs on an average $1,000 per case for medicine and nursing alone. Multiply this by 110,000, the number of cancer deaths in the United States last year, and there results an annual cancer bill of $110,000,000 according to statistics just compiled by Dr. Louis I. Dublin of the Metropolitan Life Insurance Company.

When the economic value of the victims is computed from the actual dollars and cents earning capacity of the various age groups, cancer losses run up to over $680,000,000 annually, a figure that Dr. Dublin has estimated equals a tenth of all the iron and steel manufactured in the country every year or all of the current income of the state of Louisiana. This plus the sickness costs brings the grand total up to $800,000,000.

"If we had that much money loss every year through other forces of nature we would get busy and try to prevent it," declared Dr. Dublin. "Expert engineers and others would be asked to concentrate all their faculties on the problem; but with matters of human life we are not so careful nor so anxious. . . . We must organize agencies of research on a grand scale. Then the monster of cancer will surely, in time, be brought under control, just as the menace of other diseases has been."

Science News-Letter, May 26, 1928

In This Issue—

Hugest *distance,* p. 323—Kick of gases, p. 325—*Exploring* with inventor, p. 325—*Explosive* steel engraving, p. 327—*Sphinx* may talk, p. 327—Malthus was *right,* p. 328—Evolutionary *jetsam,* p. 329—Over *headhunters* for sweets, p. 329—Began *broadcasting,* p. 331—Modern *Ajaxes,* p. 333—Learn to *avoid* it, p. 333—Evolution, chemistry, engineering and unions, p. 335.

Science News-Letter, The Weekly Summary of Current Science. Published by Science Service, Inc., the Institution for the Popularization of Science organized under the auspices of the National Academy of Sciences, the National Research Council and the American Association for the Advancement of Science.

Edited by Watson Davis.

Publication Office, 1918 Harford Ave., Baltimore, Md. Editorial and Executive Office, 21st and B Sts., N. W., Washington, D. C. Address all communications to Washington, D. C. Cable address: Scienserve, Washington.

Entered as second class matter October 1, 1926, at the postoffice at Baltimore, Md., under the act of March 3, 1879. Established in mimeographed form March 13, 1922. Title registered as trade-mark, U. S. Patent Office.

Subscription rate—$5.00 a year postpaid. 15 cents a copy. Ten or more copies to same address, 5 cents a copy. Special reduced subscription rates are available to members of the American Association for the Advancement of Science.

Advertising rates furnished on application.

Copyright 1928, by Science Service, Inc. Republication of any portion of the Science News-Letter is strictly prohibited since it is distributed for personal, school, club or library use only. Newspapers, magazines and other publications are invited to avail themselves of the numerous syndicate services issued by Science Service, details and samples of which will be gladly sent on request.

INTERPRETING week by week, the latest developments in the various fields of science, this magazine attempts also to present its articles in the most pleasing and readable topography and the most convenient arrangement.

The *clippability, indexing,* and *automatic dating* of each article are unique features.

This is a *separable* magazine. Each original article can be clipped or torn out without losing or damaging another important article on the other side. These original articles are backed by reprinted quotations or excerpts, short one-sentence items, advertisements, and other material not likely to be clipped and preserved.

Each article is automatically *indexed* by the key word printed in italics just below the heading, or at the end of the article when the article has no heading. Articles can thus be filed easily into any system of classification, whether it be Library of Congress, Dewey, or one of the reader's own devising.

Each article is automatically *dated* by its last line.

All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

1,800,000,000,000,000,000 Miles

Astronomy

By James Stokley

Our "universe" is eighteen hundred thousand million million miles across.

Such is the latest estimate of astronomers concerning the size of the Galaxy, the system of stars of which the sun, and all the stars that we can see, including those in the Milky Way, are part.

A figure as vast as that does not mean much to the astronomer or layman. Take another unit, the diameter of the earth, for example. The earth's diameter is about 8,000 miles. Therefore, if you could put 225 million million earths side by side, they would just about reach across the Galaxy. Or take the distance of the earth from the sun, about ninety-three million miles, called the "astronomical unit." Using this as a yard stick, it would be necessary to lay it down 19 billion times to measure the Galaxy's diameter.

To measure celestial distances without using inconveniently large figures, the astronomer often uses the light year. This is the distance that light, which travels fast enough to encircle the globe seven times in a second, will go in a year, or about six million million miles. This is 63,300 times the distance of the earth from the sun. It also happens that there are 63,360 inches in a mile, so that a light year is just about as big, compared to the astronomical unit, as the mile is to the inch. This possible diameter of the Galaxy, then, is about 293,000 light years.

This is the figure calculated by Frederick H. Seares, of the Mt. Wilson Observatory in California, and announced by him in a long and technical article that has just appeared in the *Astrophysical Journal*. It is the maximum, but his minimum estimate is equally impressive, for that is nearly 200,000 light years, or twelve hundred thousand million million miles.

Some place between these two figures, he believes, is the true size. Not only does he give us a new idea of how large our home galaxy is, but also of what it would be like if we could see it from outside. To us dwellers within the Galaxy, it is hard to secure an idea of what it looks like. We can't see the forest on account of the trees.

OUR GALAXY probably looks something like this, one of the spiral nebulae in which there is considerable resolution into condensations, or clusters of stars. This one is in the constellation of the Great Bear, and was photographed at the Mt. Wilson Observatory

A person in a small forest, however, might get some idea of his location within it, by studying the way the trees are distributed. If he looked one direction, and saw light spots between the trees, he would know that he was probably nearer one side than the other. So when the astronomer sees more stars in the sky in one direction than in another, he assumes that it is because the earth is located closer to that side of the swarm of stars than the other.

The thickest mass of the galactic system is in the direction of the Milky Way. It was the great English astronomer, Sir William Herschel, who suggested that the sun, together with all the stars that we see, is part of a grindstone-shaped cluster. When we look out toward the edge of the celestial grindstone, we see the stars much more closely packed than when we look towards one of the sides. This thick packing of stars is what we ordinarily call the Milky Way. Even a small telescope, or a pair of binoculars, will reveal that the apparently continuous cloud of light is really a swarm of stars.

For many years, the exact size of the galactic swarm has been a matter of more or less dispute among astronomers. Some have insisted that it must be so vast that light would take several million years to cross it from one side to the other. Light will go approximately six trillion miles in one year, so that this would make the diameter something like 12,000,000,000,000,000,000 miles! But other astronomers have just as vehemently insisted that this figure was perhaps a million times too large, and that it was only 25,000 or so light years across.

So the matter stood until recently. Apparently, there was just about as good evidence in favor of one figure as the other. The shape of the system was pretty well known. So also we knew which stars and other objects are the farthest from us. The relative proportions remained a conundrum.

Among the objects that, it was realized, must be pretty far away, were the so-called "spiral nebulae." Sir William Herschel was one of the first to see them, but his telescope was not good enough to show that they had the spiral structure. This was first demonstrated with the great six foot diameter reflecting telescope built in Ireland about 80 years ago by a nobleman, the Earl of Rosse. Only within the past fifteen years has this telescope been exceeded in size, though for many years astronomers have had instruments that worked better.

With one of the telescopes at the Lick Observatory in California, Dr. Heber D. Curtis, now the director of the Allegheny Observatory in Pittsburgh, made a series of photographs which revealed many thousands of spiral nebulae in the sky. From his, and other, researches, it became evident that they were far away. The question was then: "Are the spiral nebulae part of our galaxy, or are they separate systems outside its limits? Might it not be that the spiral nebulae themselves are systems like our galaxy, and that our galaxy is itself a spiral nebulae?"

So the controversy continued. One group of astronomers maintained that the spiral nebulae were actually parts of our system. Another insisted that they were beyond its limits, and that we are actually living in such a nebula. With good arguments on both sides, it looked as if it could hardly be settled, until Dr. Edwin P. Hubble, another Mt. Wilson astronomer, began to take photographs of two of the nebulae with the great 100 inch reflecting telescope. This is the world's largest telescope, (*Turn to next page*)

Our Galaxy Measured—*Continued*

and has been in use only since 1919. Previous photographs of spiral nebulae had showed them as continuous areas of light, just like the other nebulae. Dr. Hubble's photographs showed for the first time that the spiral nebulae consist of swarms of stars. Just as the Milky Way appears continuous to the naked eye while the telescope reveals the myriads of stars that constitute it, so the spiral nebulae appear to ordinary telescopes as continuous, while the world's largest telescope discovers the individual stars within. This made it certain that the estimate of the size of the galaxy that placed its diameter at millions of light years was definitely wrong, but still the size remained in question.

Now Dr. Seares has shown very definitely how large our Galaxy—or our home "spiral nebula"—really is. The method that he has used is one of statistics, rather than actual observations, for with so many myriads of stars as are included in the Galaxy it would obviously be impossible to measure the distances of all of them. Such would be the case even if most of them were not beyond the limits of direct measurements of distance. Statistical methods are accurate when a vast number of objects are considered although they could not be applied to find the distance of a single star.

One respect in which the spiral nebulae vary among themselves, and the way by which Dr. Hubble has classified them, is what is called "resolution." Some of the spirals are practically continuous areas of light, others are subdivided into smaller clusters, or condensations. Both of the spirals that Dr. Hubble studied particularly are thus resolved, so it may be that the condensations are the first signs of breaking up into individual stars.

Perhaps the more continuous nebulae are vast storehouses of the stuff stars are made of, and that after inconceivably great periods of time they may develop into stars. Possibly these stars may have inhabited planets, circling around them!

Dr. Hubble also discovered the distance of the spiral nebulae. This is the way he did it.

In the two nebulae he studied there were numerous members of the class of Cepheid variable stars, of which the Polestar is the most familiar. These are stars which periodically wax and wane, but do so in a peculiar manner, for they brighten suddenly, and then more gradually die out to less brilliancy.

Another thing about the Cepheid variables that astronomers have discovered is that the brighter they are on the average, the more rapidly their light changes. When an astronomer sees a star varying in this peculiar manner, he knows at once that it is a Cepheid. Then he counts the time between successive times of minimum light, and he can tell how bright it actually is. He knows how bright it appears. He knows how bright it is, and he knows how a star seems fainter when farther away. Then he can figure out its distance. This is what Dr. Hubble did with the two brightest, and presumably the nearest, of the spiral nebulae, and found that they were at the tremendous distance of about 900,000 light years. This would be something like fifty-four hundred thousand million million miles. The nearest star in the heavens, except the sun, is only about 4.2 light years, or twenty-five million million miles away, next-door, compared to these nebulae.

Astronomers realized that ours is not the only Galaxy in creation, that, scattered throughout the universe are thousands and thousands of stellar clouds similar to that of which the earth is such an insignificant part. Of all these nebulae, Dr. Seares thinks that it is one of the very highly resolved spirals that our galaxy most resembles. It is divided almost completely into stars, though here and there throughout its confines are gaseous nebulae, or huge clouds of glowing gases. Dr. Seares emphasizes the importance of another resemblance, our presence in a local cluster, smaller than the entire galaxy and similar to the condensations in the spirals. This local cluster is about a tenth of the diameter of the entire system, and some distance away from the center. Though this is much larger in proportion to the size of the complete galaxy than any known condensation in a spiral nebula, it is not impossibly great.

The work of Dr. Seares makes it now possible to picture the sort of a universe in which we live. The earth is part of the solar system, which consists of the sun, and the various planets, large and small, that revolve around it. The earth is about 93 million miles from the sun, and Neptune, the most distant of the known planets, is about two and three-quarter million miles from the sun. Leaving the sun, it is necessary to travel about twenty-five million million miles to reach the nearest star. But this star, and thousands of others around it, forming a cluster some 160 thousand million million miles in diameter, constitute a local cluster—the celestial equivalent of the state, perhaps. Our sun is near the center of this local cluster, only one-eightieth of the distance from the center to its boundary.

This local cluster, however, is some distance from the center of the Galaxy. Start at the center of the Galaxy, and travel a little less than half way to the boundary. There you would come to the center of the local cluster. There is also, believed Dr. Seares, another condensation of stars at the center of the entire Galaxy. We cannot see it, however, because of the intervening presence of dark matter scattered through the system of stars. In other spiral nebulae, especially those which present to us their edges, this dark matter is seen. Dr. Seares thinks that we see an evidence of it in our own system in the fact that in one place the Milky Way seems to divide into two branches.

So we come to the confines of our celestial "nation," the galaxy. Nine hundred thousand light years, or about 5,400 quadrillion miles from its center is the nearest of its neighboring galaxies. As far as the eye, or the photographic plate, aided by the most powerful telescope, can see, extend these spiral nebulae. Not yet is the end in sight.

Science News-Letter, May 26, 1928

The rose is state flower in four states: New York chose the cultivated rose, Georgia the Cherokee rose, Iowa the wild rose, and North Dakota the wild prairie rose.

It is estimated that if a pair of insects destructive to plants should increase for three years without hindrance there would be around six million of the pests in existence.

Although the Chinese Republic has officially adopted a calendar based on the sun, landlords greatly prefer the old lunar calendar, because once in every three years there is an extra month on which they can collect rent.

Rocket Auto May Herald New Era

Transportation

A new method of transportation with the motive power furnished by spurts of expanding gases, like the trail of a Fourth-of-July rocket, is about to make a bid for practical success.

After secret experimental development, a rocket automobile has been given speed tests at the racing track of the Fritz Opel motor-car factory at Russelsheim, near Frankfort, Germany, where it was built. Speeds of slightly over 60 miles an hour were attained eight seconds after the start.

A demonstration before experts at the Avus racing track in Berlin is scheduled for the near future. As the speeds on this track are limited to a hundred miles an hour, plans are under way to utilize later a stretch of railroad track which has been offered for this purpose by the German States Railways.

Tests of the rocket automobile are believed to be merely preliminary to the construction and launching of a rocket airplane capable of arising to heights that ordinary propeller-driven airplanes cannot possibly attain. Journeys to other planets across the great distances of airless space are theoretically possible through the use of the rocket exhaust kick as the motive power, for experiments show that the kick of the exploding rocket charge is just as effective in a vacuum where there is no air as it is under ordinary conditions where there is plenty of atmosphere. Propellers of ordinary airplanes need the air to work against. The rocket is effective in vacuum for the same reason that a rifle fired in an airless chamber would have the same sort of kick that it would in air.

The rocket airplane, once it reached the airless outer space or the upper rarified portion of the atmosphere, would attain great speeds because of the lack of air resistance.

The Opel rocket auto looks like a multiple-barrelled piece of light artillery in speedy retreat. From the rear of the car project twelve large tubes arranged in a rectangle. From these tubes the exploding gases emerge with terrific kick, which sends the car racing along the track. Any highly explosive mixtures can be used such as light gasoline, alcohol, or even pure hydrogen and oxygen mixtures which give the greatest expansion for the least weight.

The pioneer work on the rocket method of propulsion was done by Prof. R. H. Goddard of Clark University, Worcester, Mass., who has studied the problem for the past 19 years. He is now perfecting a rocket intended to travel into the rarified upper air and solve the mystery of its composition and conditions.

Ten years ago Prof. Goddard, a modern Jules Verne, interested the scientific world by publishing data supporting the practicability of a rocket flight to the moon. These researches were under the auspices of the Smithsonian Institution. He designed a rocket that could achieve a speed of 6.6 miles a second, nearly 400 miles an hour, a speed that would allow it escape from the gravitational attraction of the earth. The journey to the moon, at a still greater speed, could be made in eleven hours. The arrival of the rocket, which would not carry a pilot, would be signaled from the new moon's dimly lighted surface by an immense explosion of flashlight powder contained in the rocket's nose.

The chief utilization of the rocket method of propulsion will probably be in the airless outer space because of the low efficiency of the method. The rocket conveyance is self-consuming since it uses fuel rapidly and only a small amount of the energy in the fuel, whether gasoline, explosives or hydrogen and oxygen gases, can be made to kick the rocket along. Where the ground, as in the case of an automobile, or the air as in the case of an airplane, exists, it is better to use the wheel or the propeller to obtain traction.

Science News-Letter, May 26, 1928

Edison Could Explore Says Nobile

Geography

Gone are the days when the Arctic's secrets must be wrested by strong men skilled in ice travel. Today Edison himself might travel in an airship to the arctic and make his own observations.

Such is the opinion of General Umberto Nobile, commander of the dirigible Italia, now engaged in scientific exploration of the arctic regions. In a recent communication to the American Geographical Society General Nobile summarized as follows the revolution in exploration brought about by aviation:

"Aviation, which is bringing about profound innovations in every human activity, has opened a new era in the history of polar exploration.

"Nobody can doubt the superiority of aircraft—airplanes or dirigibles—as a means of exploring the unknown regions of the earth. We can truly say that aviation has produced a revolution in this field. In a few hours it is possible now to make a journey that in the past required months and years of travel with ships and sledges. From Spitsbergen we reached the North Pole in the Norge in sixteen hours, while Nansen in one year and eight months reached only latitude 86 degrees 14 minutes; and in only thirty hours we traversed the unexplored area between the pole and Alaska for a distance of 2000 kilometers.

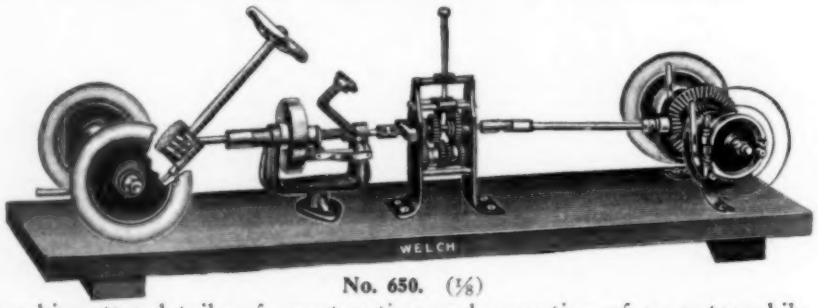
"One radical change that has taken place in the matter of polar exploration is this: Experts who know how to travel on the ice are no longer needed, and men who know how to navigate the air take their place. In addition, it is no longer necessary that the scientists of an expedition be men strong enough to support long journeys on the ice and trained in making them. Edison could be a member of an expedition of this kind and read his own instruments himself.

"Certainly there is no field of human activity so well suited as polar exploration to impart a realization of the great contribution that aerial transportation is bound to make to human knowledge; in one year it is possible to reveal what has been sought for centuries."

Unknown Land Objective

One of the few remaining unexplored areas of the world is the first objective of General Umberto Nobile's exploratory (*Turn to next page*)

AUTOMOBILE MECHANICS' MODELS



Light---
Portable---
Cut-away

No. 650. (⅛)

A necessity for teaching the details of construction and operation of an automobile.

Make auto mechanics a real vital chapter in the Physics or General Science course.

The following models are available:

Automobile Engine Model—showing cut away section of all working parts.
Steering Gear—with the worm gear application.
Clutch—showing the friction principle.
Distributor, or Timer—with miniature lights to flash at "firing" point.
Universal Joint—showing how power is transmitted in a flexible system.
Gear Shift—showing actual operation of shifting gears.
Differential and Brakes—with beveled differential gears, and both inside expanding and outside contracting brakes.

A Sign of Quality QUALITY WELCH SERVICE *A Mark of Service*

W. M. Welch Manufacturing Company

1516 Orleans Street — **Manufacturers, Importers and Exporters of Scientific Apparatus and School Supplies** — **Chicago, Ill., U. S. A.**

Edison Could Explore—*Continued*

party on the dirigible Italia, now at Spitzbergen and about to set forth on an arctic voyage.

Northern Land, also called Nicholas II. Land and Lenin Land, is known only on its eastern coast. The western coast and its extent toward the west are entirely unknown since the Russian ice-breaking ships which in 1913 discovered the new land were prevented by ice from proceeding around the northern end of the large island. The map is a blank in much of the area between the 100th and 80th meridians of longitude south of the 80th degree circle. This is the area that General Nobile hopes to map and explore scientifically.

Northern Land is totally uninhabited and is not even visited by the nomadic tribes of the Siberian tundras farther south upon the mainland. But reindeer, lemmings, polar bears and birds do make it their home.

The discovery of this new land was made just before the World War on the third voyage of the Russian ice-breakers Taimyr and Vaigach under the command of Captain Vilkitski. The presence of land close to Cape Chelyuskin, the portion of the Siberian mainland just south of Northern Land, was unexpected since the cape was circumnavigated nearly two hundred years ago by the Great Northern Expedition of 1734-1743 and later by the explorers Nordenskiold, Nansen and Toll. At the same time that Northern Land was discovered, two islands were also located for the first time. These lie southeast of Northern Land and are now known as Little Taimyr Island and Starokadomski Island. The explored coast of Northern Land consists of cliffs more than a quarter of a mile high between which glaciers descend. This area is characterized by heavy ice conditions.

After the exploration of Northern Land, Nobile intends to go to the North Pole and search for possible land in that portion of the unknown Arctic Ocean not visited by his previous dirigible expedition and the recent Wilkins flight.

Science News-Letter, May 26, 1928

A magnet more than twice as powerful as ordinary tungsten steel magnets can be made from cobalt steel.

Only two per cent of the tree struck by lightning in national for ests catch fire, but this causes 1 per cent. of the forest fires.

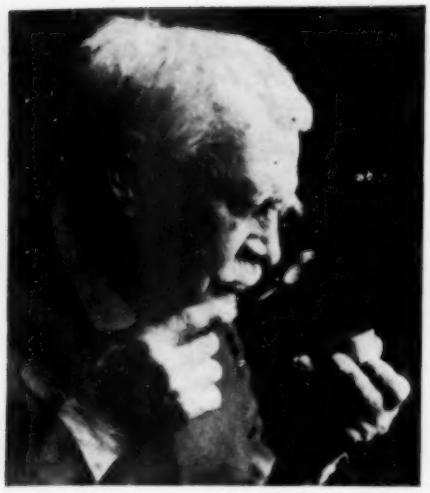
Cricket fights are a popular spor in China, and a champion cricket is valued at $100 or even more.

Staff of Science Service—Director, Edwin E. Slosson; Managing Editor, Watson Davis; Staff Writers, Frank Thone, James Stokley, Emily C. Davis, Marjorie MacDill; Sales and Advertising Manager, Hallie Jenkins.

Board of Trustees of Science Service—Honorary President, William E. Ritter, University of California. Representing the American Association for the Advancement of Science, J. McKeen Cattell, *President*, Editor, Science, Garrison, N. Y.; D. T. MacDougal, Director, Desert Labortary, Tucson. Ariz.; M. I. Pupin, Professor of Electromechanics, Columbia University, New York City. Representing the National Academy of Sciences, John C. Merriam, President, Carnegie Institution of Washington; R. A. Millikan, Director, Norman Bridge Laboratory of Physics, California Institute of Technology, Pasadena, Calif.; Dr. David White, Senior Geologist, U. S. Geological Survey. Representing National Research Council, Vernon Kellogg, *Vice-President and Chairman of Executive Committee*, Permanent Secretary, National Research Council, Washington, D. C.; C. G. Abbot, Secretary Smithsonian Institution, Washington. D C.; Harrison E. Howe, editor of Industrial and Engineering Chemistry. Representing Journalistic Profession, John H. Finley, Associate Editor, New York Times; Mark Sullivan, Writer, Washington, D. C.; Marlen E. Pew, Editor of Editor and Publisher, New York City. Representing E. W. Scripps Estate, Harry L. Smithton, *Treasurer*, Cincinnati, Ohio; Robert P. Scripps, Scripps-Howard Newspapers, West Chester, Ohio; Thomas L. Sidlo, Cleveland, Ohio.

Explodes Photograph Into Steel

Physics



DR. CHARLES E. MUNROE, explosives expert of the U. S. Bureau of Mines. Dr. Munroe discovered the Munroe effect, with which his photograph has been literally exploded into steel

Shooting a photograph into the hardest of chrome steel with the aid of high explosive nitro-gelatin, and so making a photographic record as permanent as the steel itself, is the feat that has been accomplished as a result of the "Munroe Effect." This effect was the discovery of Dr. Charles E. Munroe, veteran explosives expert of the U. S. Bureau of Mines. An incidental result of the work is the proof that the blacks in a photographic print are due to varying thicknesses of finely divided silver, the thicker the deposit the darker being the shadow in the photograph.

The steel photograph was made recently by G. St. J. Perrott, superintendent of the Bureau of Mines experiment station at Pittsburgh, and sent by him to Dr. Munroe. To make it, a photograph of Dr. Munroe was laid on a piece of steel about two inches in diameter and an inch thick. On top of this was placed a disc-shaped piece of the nitro-gelatin explosive, which was then fired. Though the paper photograph was completely destroyed, when the steel cooled sufficiently to be handled, the profile of Dr. Munroe was found impressed on the surface. Where the photograph had been black, that is, in the shadows, the surface of the steel was raised, and where there had been high lights the steel was incised.

Another example of the effect that is in Dr. Munroe's possession now was made by W. O. Snelling, director of research of the Trojan Powder Company. In this case the words "Munroe Effect" were impressed into the surface of a block of the explosive, so that the letters were in intaglio. When this was exploded on a disc of the steel the letters appeared on it. However, they were also in intaglio on the steel. This is the opposite from what would be obtained with a die, for then the intaglio letters on the die would come out in relief on the finished product.

DR. MUNROE'S PORTRAIT in chrome steel, produced by firing a charge of high explosive over the steel with a print of the photograph between

Dr. Munroe explains the effect by saying that when the detonation of the explosive occurs, the entire amount of the solid is converted to gas. This volume of gas, however, momentarily has the same size and shape as the original block of the explosive, and is, therefore, extremely compressed. Where there was a cavity in the original explosive is the line of least resistance for the escape of the rapidly moving gas molecules. In seeking to escape, they collide with each other, pro- (*Turn to next page*)

Will the Etruscan Sphinx Speak?

Archæology

By R. V. D. Magoffin,

Dr. Magoffin is president of the Archæological Institute of America and head of the Department of Classics, New York University.

Of the many as yet unsolved problems of antiquity, perhaps that of the whence, the how, and the whither of Etruscans is as troublesome and as hard as any. The Etruscan sphinx is clearly nearer every day to breaking its millenial silence.

In view of the fact that the first international meeting of the Congress of Etruscologists has just been held in Florence, Italy, where the great Etruscan museum is, it is well worth glancing at some of the things which have been done these past few years. Archæological journals in Italy, Germany, France and England have for five years been carrying articles on these mysterious and long lost Etruscans.

Excavations lately at several Etruscan sites in modern Tuscany have brought to light cemeteries showing burials of the older people in Tuscany, back as far as 1100 B. C. But about 800 B. C. in the cemeteries a new sort of burial rite, that of cremation, appears. With the burned ashes of these newcomers are found thousands of new objects, all of which are clearly importations. Most of them are of a near-oriental character which archæologists can place definitely as having come through and from Asia Minor.

The most interesting thing about the new finds in the cemeteries and rock-cut tombs is that they prove that the newcomers came to Italy by sea, not in any great horde of settlers, but slowly, probably in peaceful colonization style. The British archæologist, Dr. David McIver, rightly compares their arrival and penetration into northern Italy between the Arno and the Tiber (modern Tuscany) to the settlements made by the Norsemen in England as told by the sagas of Iceland.

The Etruscans from Asia Minor, whoever they were, won over the more numerous natives because they had a higher type of civilization, had better weapons, and being a small aristocracy, they had more cohesion in their group. Of course they also imposed their language on much of the territory in which they became overlords. An analogy is the use of the Norman-French in England in the twelfth and thirteenth centuries A. D.

A key to deci- (*Turn to next page*)

Overhead—But "Underground"

MALTHUS WAS RIGHT. The fight for room and sustenance becomes ever more bitter. It has driven a lot of little fellows to strange shifts.

They are among the world's keenest competitors for food. Four families of them make up the bulk of the animal population on the globe. In one stage of the life cycle they have chosen the interior of leaves where there is protecting and abundant food—and where quarters are almost as crowded as in a Park Avenue apartment.

Here their operations rival those of the men who dig in the earth for coal and other precious stone. They tunnel winding galleries, or excavate broad chambers between the upper and nether "skin" of the leaf. Some of them find room to stow waste away in a corner and spin a screen of white silk to cover it.

They are the leaf-mining insects—really the larvae of moths and beetles and flies. And leaf-miners are everywhere; in every lane and fence-row one may find their signatures. They take the first table at the Green Leaf Banquet—for green leaves are the world's dependence for food supply.

The story of these highly important (economically and ecologically) and interesting little chaps is told most entertainingly in

LEAF MINING INSECTS

By JAMES G. NEEDHAM of Cornell University, STUART W. FROST and BEATRICE H. TOTHILL.

The aim has been to offer an untechnical introduction to the study of leaf-miners for the student and general reader; to give an account of their natural history sufficiently detailed to be useful to the working ecologist, professional or amateur; and to provide lists of leaf-miners, their host-plants and technical papers concerning them, adequate for the specialist.

A brand new book. Indispensable to the school library. Just the thing for nature lovers who like to delve beneath the obvious.

Cloth bound. 6 x 9. viii & 351 pages. 91 illustrations. Classified bibliography. Index. Price, $6.00 postpaid

SPEAKING OF FOOD: Human beings also eat, and on what they eat depends health and oft-times wealth and happiness.

The chemist in his laboratory has taught us much about our food supply during the last quarter century—that all is not food that is chewable. We have learned to talk glibly about nutrients and calories and the curious food factors to which the name *vitamin* has been given.

Naturally the new information, coupled frequently with partial knowledge of it, has produced its appropriate share of food faddism and indiscreet claims. We are still far from knowing all about food factors, though we do know a great deal more than we did. In

NUTRITION

By WALTER H. EDDY, there is set forth a conservative statement of the things we know and why we know them, in language for the general reader—a summary of the results of these years of research and investigation, pleasingly presented by one who ranks high among the nutrition experts of the world. Dr. Eddy is Professor of Physiological Chemistry at Teachers College, Columbia, and Associate Director of the Bureau of Foods and Sanitation of "Good Housekeeping" magazine. He is the author of the popular *Vitamin Manual.*

The new book is in two parts, one dealing with general food requirements, the other with vitamin requirements. It tells what must go into a diet to make it complete; how these factors are measured; what calories are; how much protein, and how much fat and starch we should eat and why; why we require certain inorganic nutrients, minerals like iodine and calcium and iron.

In Part II we learn what vitamins are, and something of the history of their discovery; what we know of the different kinds; how food is tested for vitamin content, how cooking affects the vitamins; how vitamins function in the body; how to select them.

Clothbound. 225 pages. Index.

The price is $2.50

THE WILLIAMS & WILKINS COMPANY

Publishers of Scientific Periodicals and Books

BALTIMORE, MD., U. S. A.

Munroe Effect—*Continued*

ducing a vast number of tiny molecular drills, which bore into the hardest steel.

Using the same principle, Dr. Munroe once blew a hole in a safe with a hollow cylinder of dynamite. He took a bundle of sticks of dynamite, then, by pushing a tin can through the center, he pushed out the center sticks, and bound together the other ones so as to form a ring. This he exploded in a vertical position upon a safe. The result was a hole in the top of the safe corresponding to the hollow center in the ring of dynamite sticks. This hollow cylinder had acted as a gun to fire the gas molecules through the steel.

Any thin object, such as a leaf, or photograph, can be reproduced on steel in this way, said Dr. Munroe, and so a permanent record can be obtained. The explosion has the effect of greatly magnifying slight differences in thickness, such as between the layers of silver in the shadows and highlights of the photograph.

Science News-Letter, May 26, 1928

Rome celebrated its two thousand six hundred and eighty-second birthday by starting excavations at the site of the ancient Circus Maximus.

The city of Tacoma, Wash., has organized for a campaign against rats under the supervision of the U. S. Bureau of Biological Survey.

Nearly 10 per cent. of the area of Canada remains to be mapped.

Etruscans—*Continued*

phering the unreadable Etruscan language—not the letters, because we can read those—will not tell us very much. There are some 8,500 inscriptions in Etruscan, but they are nearly all very short, and clearly are for the most part simple epitaphs. The longest of the inscriptions is on the linen wrappings of a mummy found in Egypt.

The Etruscan alphabet is certainly derived from a Greek alphabet. But it is from a very early one, brought over in all probability from the original home of the Etruscans.

There are three examples of the early Etruscan alphabet. One is on an ivory tablet now in the museum in Florence. The second is in the Villa Giulia museum in Rome and is scratched on a vase from Formello. And the third is scratched on another pottery jar from Caere. This vase is in the Vatican at Rome.

Science News-Letter, May 26, 1928

Relicts and Disjuncts

Botany

Scattered all over the world, in out-of-the-way corners, there are little surviving groups of plants, left stranded where they are by the course of evolution, just as such things as wisdom teeth and a vermiform appendix are believed to have been left stranded in our own bodies. Such bits of evolutionary jetsam are usually known as "relict endemics."

Endemic communities usually occur where some kind of a sheltered nest is cut off from a hostile, competing world by natural barriers, leaving them to lead a cloistered life, protected from the stream of life that would otherwise swamp them. They are assumed to be the last fragments of once larger populations that held a much wider range of territory, in times when the living conditions now obtainable only in the sheltered corners dominated the whole terrain. Sometimes we can find the main body of the army, resting after a long retreat to another region. In such a case the stranded patch of plants is called a disjunct, instead of a relict, endemic.

Such relict and disjunct communities may be found in almost all parts of the country, except in regions of monotonously regular climatic and soil conditions, such as the Great Plains. They are, conversely, especially to be looked for in a broken terrain or in regions of marked climatic contrasts within narrow limits, and sometimes the natural barriers that protect them are very slight, so far as our power to detect them goes. Of course, the less the barrier, the more rapidly the beleaguered community is doomed to go under and become finally extinct.

An excellent case in point is furnished by the Torrey Pines, a little cluster of almost Japanese-appearing trees that hold the tops of two hills at the northern end of the city limits of San Diego, Calif. There are also a few of them on one of the Channel Islands off the coast, many miles to the north. There is no doubt that once a Torrey Pine forest held sway over a much greater portion of southern California, but the all-pervading chaparral now has the remnant with its back against the wall. Perhaps the change has been encouraged by a shifting climate. The survival of the last members of the species here on the hilltops by the ocean seems to have been due to the fact that these particular hills have been relatively free from brush fires. Chaparral fires are common in southern California. The chaparral itself recovers quickly from them, but they are fatal and final to young pine trees. Thus, fire may have worked in favor of the invading brush in all places save this last precarious stronghold of the pines. At any rate, there they still are, holding obstinately to their hills; and no visitor to San Diego has done his duty by this southwestern corner of the country until he has seen the Torrey Pines.

Less desperate is the plight of another California relict endemic area, the Monterey peninsula. Here grow, among other highly interesting plants, two tree species, the Monterey Cypress and the Monterey Pine. There is no easily seen (*Turn to next page*)

Sugar Cane Hunt Begun From Air

Agriculture

Flying over the land of the head-hunters and exploring in a few hours jungle country that would take months to transverse on foot, a U. S. Department of Agriculture expedition to New Guinea this summer will search for wild varieties of sugar cane that may bring added wealth to America's sugar planters.

The party, led by Dr. E. W. Brandes in charge of the government's sugar plant investigations, includes Dr. Jakob Jeswiet of the University of Mageringen in Holland, who for 15 years was in charge of the cane improvement division of the Experiment Station for the Java Sugar Industry, E. C. Pemberton, an entomologist on the staff of the experiment station of the Hawaiian Sugar Planters' Association, and Richard K. Peck, airplane pilot, who is a veteran of a previous aerial expedition to the wilds of the East Indies.

Back of the sailing, on April 12 from San Francisco, of these saccharine-bent aviators lies a story of agricultural romance that has few counterparts in history, if any.

Until two years ago, the Louisiana sugar-cane industry was slowly dying of wasting diseases. The sugar-cane mosaic, carried from plant to plant by the corn aphid, had spread over the entire cane area. A root-rot complex (plants have complexes, like human beings) added to the misery of the Louisiana planter. The only way known to combat those diseases was by thorough "roguing" of the fields, but what help was that if entire fields were affected? One might as well dig it all up—did dig it up often—and start all over again with a whole year lost.

Then came the "P. O. J." canes, first brought in by Dr. Brandes and his associates in the Bureau of Plant Industry from Argentina, where they had been imported from the "Proefstation Oost Java," whence the name.

These canes had shown a disease that of the varieties commonly grown. They get the mosaic, but it does not affect them. They may not produce quite so much sugar per ton of cane, but they produce so much cane per acre that the net sugar production is much larger.

As a result of Brandes' study of the various P. O. J. canes, three varieties, P. O. J. 36, 213 and 234 were recommended for trial in Louisiana

In April, 1922, Elliott Jones, field manager of Southdown Plantation, Houma, La., took a few short pieces of P. O. J. 234 back to the plantation from the Department of Agriculture greenhouse in Washington. That was the beginning of this variety in the state.

And now the romance. The flood threatened Southdown Plantation in 1927. Here by this time was the largest nursery of P. O. J. 234 in Louisiana. The "Sugar Bowl" was given up to the flood, and with it most of the acreage of the old, susceptible varieties, such as D-74, Louisiana Purple and Louisiana Striped (ribbon cane). If Southdown and its P. O. J. canes were saved, the whole sugar bowl could be replanted to the disease-tolerant canes. Would the planters below Southdown consent to the cutting of the levees, so that the P. O. J. canes on Southdown could be saved, even at the expense of overflow of their own lands? They would, and they did.

As a result, practically all of the sugar district in Louisiana is now growing P. O. J. canes, largely from seed cane saved by this remarkable demonstration. A (*Turn to next page*)

Relicts and Disjuncts—*Continued*

reason why they should not be growing all along the California coast; they thrive in cultivation, as does the Torrey Pine, and their leaves and cones have been found embedded in the Carpinteria asphalt pits, many miles to the south of their present home. But something has crowded them out of all other parts of their original habitat—and the Monterey peninsula today is a mecca for plant ecologists, who come thither to attempt to read the riddle of these two trees.

There is another very notable endemic species in California, a fine fan palm named *Washingtonia* in honor of George Washington. It occupies in force a canyon in the hills 22 miles east of Banning, Riverside County, and occurs in a number of other places also. The Washington palm has come to be a great favorite as a street tree in California.

California's great rival state, Florida, can also boast of its endemic floras. Perhaps the most classic is the Torreya colony, occupying a series of ravines that cut back from the east bank of the Appalachicola River between the cities of Chattahoochee and Bristol. In this area, which is about twenty miles long and from a half-mile to four or five miles wide, can be found a strange yew-like tree, the Torreya, or savin, or stinking cedar, or, in botanists' Latin, *Tumion*. It is found only in the depths of the ravines and on well-sheltered creek bottoms; on the uplands it does not venture. It has relatives in California and in Japan and China, but of this particular species, *Tumion taxifolia*, this little area is the only home. In the same region, and nowhere else, grows the Florida yew, *Taxus floridana*. This nest of ravines is hard to penetrate, but Torreya can be seen within the city limits of Chattahoochee. Botanically minded persons might do well to make a pious visit to this tree, for one of the classic papers of Asa Gray is entitled, "A Pilgrimage to Torreya."

A second Florida endemic, very recently discovered, is a remarkable patch of wild gooseberries along the shore of a little lake near Tallahassee. It created more or less of a sensation in the botanical world, for nobody had ever dreamed of a wild gooseberry growing in Florida, and this was a new species to boot. It is probably neither a relict nor a disjunct, but what may be called an initial endemic; that is, a new species just getting its start, which has not yet had time to spread.

A most interesting endemic plant, which may possibly be another initial endemic, is the famous Venus flytrap, which grows only in the neighborhood of Wilmington, N. C. This is one of the class of insect-eating plants; the outer ends of its longitudinally hinged leaves snap shut like steel traps on any insect unfortunate enough to blunder against certain trigger-bristles they carry, after which the luckless creature is digested and assimilated by this bloodthirsty vegetable.

There may be an endemic group of plants in your own neighborhood; this is a very large country and has not yet been really thoroughly explored botanically. Endemic-hunting is great sport for one with a bit of training in botany and plenty of patience to search the ravines and odd corners of the woods.

Science News-Letter, May 26, 1928

Opium Bondage

Sociology

JOHN PALMER GAVIT, in *"Opium"* (Brentano's): The Chinese have "The Ten Cannots" to describe the condition of the opium addict. He cannot—

1. Enjoy sleep.
2. Rise early.
3. Be cured if sick.
4. Plan anything.
5. Walk any distance.
6. Enjoy wealth.
7. Help needy relations.
8. Get credit, even if an old customer.
9. Decently await his turn to smoke.
10. Give up the habit.

Science News-Letter, May 26, 1928

Because of the abundance of food supply in Southern California, that region supported a larger population of Indians than any similar area in this country.

In the course of his campaign to raise Italy's low birthrate, Premier Mussolini has distributed over $25,000 to the heads of 1,300 large families in the past six months.

Sugar Cane Hunt—*Continued*

new page has been turned on which is being written the story of the comeback of an industry which had almost been given up as hopeless. The flood of 1927 was made to serve a useful end.

After the flood-waters receded, Nature compensated for her violence by giving the best she had for a favorable cane-growing season. The yield of P. O. J. 234 at Southdown Plantation in 1927 averaged 25 tons per acre. The University at Baton Rouge reported a yield of 41 tons for P. O. J. 213, yields of 43 tons were reported at other points, and predictions are made that when the P. O. J. canes get into full production the average yield of the state will be 25 tons of sugar cane per acre. Contrast this with the record of the old canes, slipping, slipping, slipping from an average yield of about 15 tons per acre to around 10 tons, to less than 7 tons in 1926, and you see what is happening in Louisiana.

These P. O. J. canes are more than disease-resistant. In the hurricane of August 25, 1925, which laid the cane fields flat at Southdown, the P. O. J. fields suffered very little breakage compared with adjacent fields of D-74. The P. O. J.s pulled themselves erect after the storm and started in to grow new leaves to replace those which had been broken off.

But that is not all. P. O. J. canes are hardy, frost-resistant, and Louisiana now has visions of an extension of the sugar-growing area beyond its present limits.

The P. O. J. canes are hybrids, developed by crossing wild varieties of cane that are immune, resistant or tolerant to disease but low in sugar content, on domesticated varieties which are high in sugar content but susceptible to disease.

Hence, the point to and reason for the Brandes expedition. If Brandes can find wild varieties which carry more sugar than and as much disease resistance as those used to produce P. O. J.s he will get what he went for.

Every good American with a sweet tooth in his head, and that's all of us, will pray that no head-hunter gets Brandes.

Science News-Letter, May 26, 1928

The average Canadian eats an egg and a half a day, whereas the average person in the United States eats only half an egg.

CLASSICS OF SCIENCE:

Hertz on Electric Waves

Physics

In performing these experiments, Hertz covered one wall of the laboratory with sheet zinc to act as a reflector, and suspended the apparatus here described high in the air above the laboratory desks.

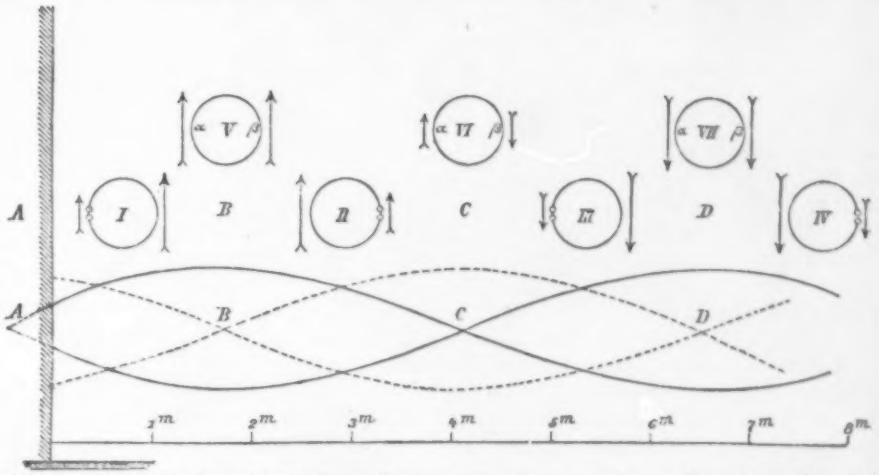
ELECTRIC WAVES; being researches on the propagation of electric action with finite velocity through space. By Dr. Heinrich Hertz. Authorised English translation by D. E. Jones, with a preface by Lord Kelvin. London and New York, 1893.

The Apparatus

Before we proceed to develop the theory, we may briefly describe the apparatus with which the experiments were carried out, and to which the theory more especially relates. The primary conductor consisted of a straight copper wire 5 mm. in diameter, to the ends of which were attached spheres 30 cm. in diameter made of sheet-zinc. The centres of these latter were 1 metre apart. The wire was interrupted in the middle by a spark-gap ¾ cm. long; in this oscillations were excited by means of the most powerful discharges which could be obtained from a large induction-coil. The direction of the wire was horizontal, and the experiments were carried out only in the neighbourhood of the horizontal plane passing through the wire. This, however, in no way restricts the general nature of the experiments, for the results must be the same in any meridional plane through the wire. The secondary circuit, made of wire 2 mm. thick, had the form of a circle of 35 cm. radius which was closed with the exception of a short spark-gap (adjustable by means of a micrometer-screw).

Plotting the Electric Wave

If the experiment is arranged at a distance of about 0.8 metre from the wall the sparks are much stronger when the spark-gap is turned towards the wall. The length of the sparks can be so regulated that a continuous stream of sparks passes over when the spark-gap is turned towards the wall, whereas no sparks whatever pass over in the opposite position. If we repeat the experiment at a distance of 3 metres from the wall we find, on the contrary, a continuous stream of sparks when the spark-gap is turned away from the wall, whereas the sparks disappear when the spark-gap is turned towards the wall. If we proceed further to a distance of 5.5 metres, a fresh reversal has taken place; the sparks on the side towards the wall are stronger than the sparks on the opposite side. Finally, at a distance of 8 metres from the wall, we find that another reversal has been executed; the sparking is stronger on the side remote from the wall, but the difference is no longer so noticeable. Nor does any further reversal occur; for it is prevented by the preponderating strength of the direct action and by the complicated forces which exist in the neighbourhood of the primary oscillation. Our figure (the scale in which indicates the distances from the wall) shows at I., II., III., IV., the secondary circle in those positions in which the sparks were most strongly developed. The alternating character of the conditions of the space is clearly exhibited.



ELECTRIC AND MAGNETIC WAVES reflected from the wall, as traced out in Hertz' experiment

At distances lying between those mentioned both sets of sparks under consideration were of equal strength and in the immediate neighbourhood of the wall too the distinction between them diminishes. We may therefore denote these points—namely, the points *A, B, C, D* in the figure—as being nodal points in a certain sense. Still we must not consider the distance between any one of these points and the next as being the half-wave length. For if *all* the electrical disturbances change their direction in passing through one of these points, then the phenomena in the secondary circle should repeat themselves without reversal; for in the spark-length there is nothing which corresponds to a change of direction in the oscillation. We should rather conclude from these experiments that in passing through any one of these points one part of the action undergoes reversal, while another part does not. On the other hand, it is allowable to assume that double the distance between any two of the points corresponds to the half wave-length, so that these points each indicate the end of a quarter wave-length. And, indeed, on the basis of this assumption and of the fundamental view just expressed, we shall arrive at a complete explanation of the phenomenon.

For let us suppose that a vertical wave of electric force proceeds towards the wall, is reflected with slightly diminished intensity, and so gives rise to stationary waves. If the wall were a perfect conductor a node would form at its very surface. For inside a conductor or at its boundary the electric force must always be vanishingly small. Now our wall cannot be regarded as a perfect conductor. For, in the first place, it is only metallic in part, and the part which is metallic is not very extensive. Hence at its surface the force will still have a certain value, and this in the sense of the advancing wave. The node, which would be formed at the wall itself if it were perfectly conducting, must therefore lie really somewhat behind the surface of the wall, say at the point *A* in the figure. If double the distance *A B*, that is the distance *A C*, corresponds to the half wave-length, then the geometrical relations of the stationary wave are of the kind which are represented in the usual symbolic fashion by the continuous wave-line in the (*Turn to next page*)

Electric Waves—*Continued*

figure. The forces acting on both sides of the circle in the positions *I*, *II*, *III*, and *IV* are correctly represented for any given instant in magnitude and direction by the arrows at the sides. If, then, in the neighborhood of a node the spark-gap is turned towards the node, we have in the circle a stronger force acting under favorable conditions against a weaker force, which acts under unfavorable conditions. But if the spark-gap is turned away from the node, the stronger force now acts under unfavourable conditions against a weaker force, which in this case is acting under favourable conditions. And whether in this latter case the one preponderates or the other, the sparks must necessarily be weaker than in the former case. Thus the change of sign of our phenomenon every quarter wave-length is explained.

Our explanation carries with it a means of further testing its correctness. If it is correct, then the change of sign at the points *B* and *D* should occur in a manner quite different from the change of sign at *C*. At *V*, *VI*, and *VII* in the figure the circle and the acting forces in these positions are represented, and it is easily seen that if at *B* or *D* we transfer the spark-gap from one position to the other by rotating the circle within itself, the oscillation changes its direction relatively to a fixed direction within the circle; during this rotation the sparks must therefore become zero either once or an uneven number of times. On the other hand, if the same operation is performed at *C*, the direction of the oscillation does not change; and therefore the sparks must either not disappear at all, or else they must disappear an even number of times. Now when we actually make the experiment, what we observe is this:—At *B* the intensity of the sparks diminishes as soon as we remove the spark-gap from *a*, becomes zero at the highest point, and again increases to its original value when we come to *B*. Similarly at *D*. At *C*, on the other hand, the sparks persist without change during the rotation, or, if anything, are somewhat stronger at the highest and lowest points than at those which we have been considering. Furthermore, it strikes the observer that the change of sign ensues after a much smaller displacement at *C* than at *B* and *D*, so that in this respect also there is a contrast between the change at *C* and that at *B* and *D*.

The representation of the electric wave which we have thus sketched can be verified in yet another way, and a very direct one. Instead of placing the plane of our circle in the plane of oscillation, let us place it in the wave-plane; the electric force is now equally strong at all parts of the circle, and for similar positions of the sparks their intensity is simply proportional to this electric force. As might be expected, the sparks are now zero at the highest and lowest points of the circle at all distances, and are strongest at the points along the normal in a horizontal plane. Let us then bring the spark-gap into one of these latter positions, and move slowly away from the wall. This is what we observe:—Just at the conducting metallic surface there are no sparks, but they make their appearance at a very small distance from it; they increase rapidly, are comparatively strong at *B*, and then again diminish. At *C* again they are exceedingly feeble, but become stronger as we proceed further. They do not, however, again diminish, but continue to increase in strength, because we are now approaching the primary oscillation. If we were to illustrate the strength of the sparks along the interval *A D* by a curve carrying positive and negative signs, we should obtain almost exactly the curve which has been sketched. And perhaps it would have been better to start from this experiment. But it is not really so striking as the first one described; and furthermore, a periodic change of sign seems to be a clearer proof of wave-motion than a periodic waxing and waning. * * *

The Magnetic Wave

We are now quite certain that we have recognised nodes of the electric wave at *A* and *C*, and antinodes at *B* and *D*. We might, however, in another sense call *B* and *D* nodes, for these points are nodes of a stationary wave of magnetic force, which, according to theory, accompanies the electric wave and is displaced a quarter wave-length relatively to it. This statement can be illustrated experimentally as follows:—We again place our circle in the plane of oscillation, but now bring the spark-gap to the highest point. In this position the electric force, if it were homogeneous over the whole extent of the secondary circle, could induce no sparks. It only produces an effect in so far as its magnitude varies in various parts of the circle, and its integral taken around the circle is not zero. This integral is proportional to the number of lines of magnetic force which flow backwards and forwards through the circle. In this sense, we may say that in this position, the sparks measure the magnetic force, which is perpendicular to the plane of the circle. But now we find that in this position near the wall there is vigorous sparking which rapidly diminishes, disappears at *B*, increases again up to *C*, then again decreases to a marked minimum at *D*, after which it continuously increases as we approach the primary oscillation. Representing the strength of these sparks as ordinates with positive and negative signs, we obtain approximately the dotted line of our figure, which thus represents correctly the magnetic wave. The phenomenon which we first described can also be explained as resulting from the co-operation of the electric and the magnetic force. The former changes sign at the points *A* and *C*, the latter at the points *B* and and *D*; thus one part of the action changes sign at each of these points while the other retains its sign; hence the resulting action (as the product) changes sign at each of the points. Clearly this explanation only differs in mode of expression, and not in meaning, from the one first given.

Heinrich Rudolf Hertz was born at Hamburg, Germany, February 22, 1857, and died at the age of 37 at Bonn, January 1, 1894. In 1878 he became a pupil of Kirchoff and of Helmholtz in Berlin. He plunged at once into original research, and was regarded by Helmholtz as the most brilliant student he had ever had. In 1880, at the age of 23, he published "Kinetic Energy of Electricity in Motion" and took his doctor's degree with "Induction in Rotating Spheres." Between 1885 and 1889 he made his famous discoveries in electromagnetic phenomena.

Science News-Letter, May 26, 1928

X-rays of a singer's skull reveal considerable information about the range of a voice and its possibilities, a professor of music has reported.

A model community, with fast motor routes for automobiles, and parkways and garden paths for children and pedestrians, is planned 18 miles from New York City.

Sightseers are now admitted to the Great Mosque of Hebron, built over a cave said to contain the bodies of Abraham and Sarah, Isaac and Rebecca, and Jacob and Leah.

Skyscrapers as Lightning Rods

Physics

Tall buildings and lightning rods mounted on high towers protect neighboring structures from lightning, provided they are not so high as to extend out of the cone of protection. This protected area extends around the base of the high building for a distance of between two and four times its height. Imaginary lines drawn from the top of the building to the edge of the protected area define the protected cone, says F. W. Peek, Jr., in charge of the General Electric Company's high-voltage investigations.

Mr. Peek's investigations have been made with artificial lightning at pressures of as high as three and a half million volts. These man-made flashes have been used on small models of buildings. However, confirmation of his discoveries was obtained by studying a natural electrical storm that occurred in New York last summer, and during which the New York World building was struck. Though this building is close to the Woolworth Tower and is in the 1,100-foot circle around its base that is protected, the dome of the World building extends for about a hundred feet outside the cone, and that is the reason that it was struck, explains Mr. Peek. If it had been 200 feet closer the Woolworth building, it would have been protected.

Practical application of these experiments, says Mr. Peek, has already been made in California, in safeguarding oil storage tanks from lightning. Several tall rods, placed outside the big reservoirs, provide overlapping cones of protection and reduce the danger to a minimum.

Science News-Letter, May 26, 1928

Ornithevolution

Palæontology

The Archæopteryx, a primitive bird, is believed to have evolved from a reptile.

Ma Sauropod, a reptile odd,
In ages Carboniferous,
Had made her nest; had done her best;
And then became vociferous.

"Oh, Pa!" cried she, "Do come and see!
I shouldn't set, I warn you!
I hesitate to incubate
The funny eggs I've borne you!"

"Pooh, pooh!" said Pa, "What ails you Ma?
Don't tell me you're afraid
To try and hatch the little batch
Of progeny you've laid!"

"Oh, well," she hissed, "If you insist,
I'll hatch the horrid brood!"
To end the spat she sat and sat,
And hatching soon ensued.

Ma Sauropod exclaimed, "Ecod!
What's this my gaze transfixes!
I feared as much! Oh, what a clutch
Of Archæopteryxes!"

Richard Ashman.

Science News-Letter, May 26, 1928

Instruments Record Quake

By means of records obtained on seismograph instruments at observatories as distant as Massachusetts, Alaska, Hawaii and the Philippine Islands, and gathered by Science Service, the earthquake experts of the U. S. Coast and Geodetic Survey here have located the center of the quake on Monday afternoon, May 14. It was at latitude 8.0 degrees south and longitude 80.5 degrees west, and occurred at 5 hours 14 minutes 20 seconds p. m., Eastern Standard Time. This location is in the Pacific Ocean about 70 miles off the Peruvian coast. Fortunately for residents of this region, the slip of the ocean bed which produced it was mostly in a horizontal direction. Had the shaking been up and down, a severe tidal wave would doubtless have been the result.

At Guayaquil, Ecuador, nearly four hundred miles to the north of the center of the shake, severe shaking was reported. This, and the fact that seismograph observatories at such distant points recorded it, shows that it was a quake of great severity.

The seismograph stations that reported their records of the quake to Science Service were those of the U. S. Coast and Geodetic Survey at Tucson, Arizona; Sitka, Alaska; Honolulu, T. H., and Chicago, Ill.; of the Jesuit Seismological Association at Georgetown University, Washington; Fordham University, New York; Regis College, Denver; Loyola University, New Orleans, and St. Louis University, St. Louis, and the stations of Harvard University, Cambridge; the Dominion Observatory, Ottawa, Canada, and the Manila Observatory in the Philippine Islands.

Science News-Letter, May 26, 1928

Nature Ramblings

By Frank Thone

Natural History

III Weeds

Now is the time when schools and churches and any other groups of people who have any excuse at all for getting out of doors plan picnics. And by an evil coincidence poison ivy, about the most universally distributed plant pest in America, is coming into bloom, and according to widespread opinion is at the climax of its virulence.

The plant is not hard to recognize, if you will look about a bit before spreading your picnic cloth or hanging up your hammock. It grows as a low, little branched shrub out of the ground, or climbs up the trunks of trees as a close-clinging vine, with innumerable aerial roots with which to hang onto the bark. In either case, however, its leaves are the same; compound affairs with three broadly ovate leaflets; really rather attractive things, with their glossy green shine. The flowers are slender, irregular pyramids of tiny white bloom.

It is very easy to get poisoned with poison ivy; that happens on the mildest of country walks, for poison ivy is everywhere. Poison sumac is reserved for slightly hardier souls, who go in for hiking or nature-study activities that may require wet feet, because poison sumac is a creature of the bog-edges, and does not grow in upland woods at all. This is perhaps fortunate, for though fewer persons are susceptible to it, the luckless ones it does affect get a much worse "dose", usually, than poison ivy is able to inflict.

Poison sumac is easy enough to identify. First, it is always in low ground, usually in wet ground. Second, it looks much like ordinary sumac, except that its bark is a pallid gray. Third, its fruits (which persist on their stalks for a long time) are quite unlike those of ordinary sumac, being round, white, somewhat waxy (*Turn to next page*)

Bacteriophage as a Specific Antigen

Bacteriology

J. BRONFENBRENNER, in *The Newer Knowledge of Bacteriology and Immunology* (Univ. of Chicago Pr.):

It has just been suggested that the particles seemingly endowed with the power of initiating transmissible lysis may not represent autonomous "corpuscles" of a parasite, but serve merely as a vehicle on which the active principle is absorbed. The active agent itself, however, may still be particulate, i. e., may consist of minute aggregates composed of a number of molecules each, and these small aggregates may still possess all the characteristics previously ascribed to larger carrier-particles. These aggregates, though perhaps considerably smaller than 20 $\mu\mu$ in diameter, may still represent, according to the definition of D'Herelle, "colloidal micellae which differ from other forms of life only in their size." That the active agent may not be a crystalloid is suggested, for instance, by its behavior with respect to solubility. Once dried, the preparations of bacteriophage cannot be brought to the state of initial dispersion in water. This is particularly true of purified preparations of bacteriophage deprived of all, or nearly all, of the extraneous material. The colloidal nature of the active agent is further evidenced by the fact that it acts as an antigen and causes the production of specific antibodies when introduced parenterally into experimental animals. While the antisera thus obtained are capable of neutralizing the activity of the bacteriophage, they usually show simultaneously the presence of agglutinins, opsonins, precipitins, and complement-fixing antibodies for homologous bacteria. Moreover, purely antibacterial sera apparently possess the power to inhibit the progress of lysis by homologous bacteriophages. In spite of the inference suggested by these findings, it has been possible to establish that the active principle possesses independent (autonomous) antigenic value. Thus, when sera prepared by immunization with filtrates of lysed cultures are absorbed with homologous bacteria, they no longer react with bacteria and their products, but retain their power to neutralize the bacteriophage unimpaired. If the filtrates of lysed cultures are purified by removal or digestion of bacterial protein, leaving only the active principle, the anti-sera obtained by immunization with such purified preparations do not react with bacteria, while they do neutralize the phage. Moreover, in the case of phages capable of acting on several related species of bacteria, the antigenic specificity of the filtrate is constant for each phage and is independent of the bacterial substratum which was used to obtain the active filtrate.

As for the phage-inhibiting activity of antibacterial sera, it has been demonstrated that this action is not directed against the phage, but against the bacteria, rendering them less susceptible to lysis. It has been suggested that this effect is probably due to the saturation by agglutinins of receptors susceptible to union with phage.

It appears then that when filtrates of lysed cultures are used in immunization of animals, the agent of transmissible lysis acts as a specific antigen, independently of other antigens, notably those of bacterial origin, present in the filtrates at the same time. The question naturally arises: Is the active agent therefore to be considered an autonomous, organized being, totally foreign to bacteria and multiplying at their expense, or can it still be a product of bacteria, accumulating in the culture during the growth or during the lysis of bacteria, but antigenically distinct from them?

Science News-Letter, May 26, 1928

New flying rules established by the Department of Commerce prohibit acrobatic maneuvers at less than 1,500 feet.

The barking sands in the Hawaiian Islands give forth a sound like the barking of a dog when rubbed together or slid over.

The question of whether the exhibition of mummies of ancient kings is disrespectful to their dignity has been raised in Egypt.

Ill Weeds—Continued

berries in drooping clusters instead of the crowded erect masses of black seeds of the upland sumacs.

It is possible to insure oneself against ivy and sumac poisoning. If you know you are susceptible, wash your hands and face in a five per cent. solution of ferric chloride in water—your druggist can mix it for you—and let it dry on the skin. A little glycerine added will make it more agreeable to apply. That will neutralize the poison when you meet it.

If you have not taken this precaution, and find yourself poisoned, then use a three to five per cent. solution of potassium permanganate, which your druggist can also supply. Swab it on with a bit of cotton. It will sting a bit, but it will kill the poison. The brown stain on the skin can be removed afterward with a one per cent. solution of oxalic acid.

Science News-Letter, May 26, 1928

BINDER COVERS
FOR
SCIENCE NEWS-LETTER

Many subscribers have expressed a desire for a convenient binder in which to file their copies of the Science News-Letter. We therefore have prepared an attractive and durable loose-leaf binder-cover of gray leather-like stock, printed in dark green and complete with fasteners. Each binder-cover will hold one volume (six months or 26 issues).

To facilitate punching the issues of the Science News-Letter to fit this binder-cover, a pattern showing where holes should be placed appears each week on the back cover page.

To obtain a binder-cover, send 20 cents in stamps (make them 2s, please), together with your name and address (please print) to

SCIENCE SERVICE
21st and B Sts.
Washington, D. C.

FIRST GLANCES AT NEW BOOKS

CREATION BY EVOLUTION—Edited by Frances Mason—*Macmillan* ($5). Twenty-six of the foremost American and British workers in all branches of biology and natural history have contributed to what sums up as a most readable and instructive book. The coming winter, which will see most of the state legislatures in session, will also inevitably see the usual crop of anti-evolution bills. Some one should see that chairmen of committees on education and all other legislators who occupy key positions are provided with copies of this book.

Evolution

Science News-Letter, May 26, 1928

EMERGENT EVOLUTION AND THE DEVELOPMENT OF SOCIETIES—William Morton Wheeler—*Norton* ($1). Prof. Wheeler presents a brief but incisively thought out discussion of one of the perennial paradoxes of scientific philosophy: how a developing individual or society seems to consist of more than the sum of its several parts.

Philosophy

Science News-Letter, May 26, 1928

GROWING INTO LIFE—David Seabury—*Boni and Liveright* ($5). A comprehensive book which aims to show the adult reader how feelings and ideas, and sometimes abnormalities, develop in adolescents. The author concludes an introductory plea for keener understanding of youth by suggesting, "think how different our parents might have been if our grandparents had only understood them." The subjects discussed, from "Open and Closed Minds" to "Creating Neurotic Children," are the stuff that the modern parents' problems are made of, and the help that mental hygiene and preventive psychology are prepared to give is very well presented.

Hygiene

Science News-Letter, May 26, 1928

INSECTS—Frank Balfour-Browne—*Holt*. This book, one of the Home University series, shows good choice on the part of the author in selecting and condensing from the mass of data available the things that should go into an entomological First Reader. The amateur will find the concluding chapter, Hints on Collecting Insects, a very useful one.

Entomology

Science News-Letter, May 26, 1928

HANDBOOK OF CHEMISTRY AND PHYSICS—Charles D. Hodgman and Norbert A. Lange—*Chemical Rubber Co.* ($5). In the twelfth edition of this well known and useful manual, it has grown to 1112 pages, but, with the thin paper used, it is kept to the modest thickness of 3 cm. Practically all the tables and data that are commonly desired are found within its pages, such as logarithms, atomic weights, isotopes, X-ray spectra, positions of bright stars, etc.

Chemistry-Physics

Science News-Letter, May 26, 1928

FUNDAMENTALS OF MODERN CHEMISTRY—Herbert R. Smith and Harry M. Mess—*Holt*. A new chemical textbook into which are incorporated some of the usual features of the laboratory manual. The authors have endeavored, as indicated in the title, to present the fundamentals, without the large amount of extraneous matter that helps fill the usual text, but in so doing they seem to have lost a lot that makes the older type of text attractive to the student.

Chemistry

Science News-Letter, May 26, 1928

MATHEMATICAL PREPARATION FOR PHYSICAL CHEMISTRY — Farrington Daniels—*McGraw-Hill* ($3). The title of this book, the latest in the publishers' "International Chemical Series," fully expresses its function. It treats of the use of logarithms, the slide rule, graphs, calculus, infinite series and probability in general, in addition to the specific relation to physical chemistry, so that the book should be useful to anyone desiring a general work on higher mathematics.

Mathematics

Science News-Letter, May 26, 1928

MATTER, ELECTRICITY AND ENERGY Walter Gerlach—*Van Nostrand* ($6). A translation by Dr. Francis J. Fuchs of the second German edition of Professor Gerlach's work. It is a comprehensive, though necessarily technical, survey of the principles of modern atomic theory.

Physics

Science News-Letter, May 26, 1928

THE MODERN CALORIMETER—Walter P. White—*Chemical Catalog* ($4). A small but complete treatise on the entire subject of the measurement of heat by means of temperature change in suitable bodies.

Physics

Science News-Letter, May 26, 1928

HOST-PARASITE RELATIONS BETWEEN MAN AND HIS INTESTINAL PROTOZOA—Robert Hegner—*Century* ($3.50). One of the foremost of living protozoologists here attacks the very difficult problem of the physiological relationships between man and the swarming hosts of creatures that live in his lower digestive tract. This book will be an indispensable *vademecum* for protozoologists, physicians, sanitarians, whether engaged in practice, research or teaching.

Protozoology

Science News-Letter, May 26, 1928

ELEMENTARY BACTERIOLOGY—J. E. Greaves and Ethelyn O. Greaves—*Saunders* ($3.50). A well-organized textbook for a first college course in bacteriology.

Bacteriology

Science News-Letter, May 26, 1928

MASTER MINDS OF MEDICINE—By John C. Hemmeter—*Medical Life Press* ($10.00). A study of the reciprocal relation between the great minds which the human race has produced in the field of medicine and society at large. Three chapters are devoted to the influence of Leonardo da Vinci as a scientist.

Medicine

Science News-Letter, May 26, 1928

THE ELEMENTS OF INDUSTRIAL ENGINEERING—George Hugh Shepard—*Ginn* ($4.80). A comprehensive textbook of the principles of management as applied to industry, and one which aims to correlate the student's daily life with the problems he will encounter later.

Engineering

Science News-Letter, May 26, 1928

COMPANY UNIONS—R. W. Dunn—*Vanguard Press* ($.50). One of the most debated phases of present-day industrial development is discussed from the point of view of a somewhat left-wing orthodox labor unionist.

Sociology

Science News-Letter, May 26, 1928

THE CHANGING SOUTH—W. J. Robertson—*Boni and Liveright* ($3). The writer of this sociological and economic study of the post-war (i. e. post-world-war) South has some very decided opinions and does not hesitate to state them vigorously, even vehemently.

Sociology

Science News-Letter, May 26, 1928

A Statement of Purpose

(The aims, ideals and aspirations of an institution)

SCIENCE SERVICE is a unique institution, established at Washington for the purpose of disseminating scientific information to the public. It aims to act as a sort of liaison agency between scientific circles and the world at large. It interprets original research and reports the meetings of learned societies in a way to enlighten the layman. The specialist is likewise a layman in every science except his own and he, too, needs to have new things explained to him in non-technical language. Scientific progress is so rapid and revolutionary nowadays that no one can keep up with it from what he learned at school. Science Service endeavors to provide life-continuation courses in all the sciences for newspaper readers anywhere in America without tuition fees or entrance examinations.

In a democracy like ours it is particularly important that the people as a whole should so far as possible understand the aims and achievements of modern science, not only because of the value of such knowledge to themselves but because research directly or indirectly depends upon popular appreciation of its methods. In fact the success of democratic institutions, as well as the prosperity of the individual, may be said to depend upon the ability of people to distinguish between science and fakes, bewteen the genuine expert and the pretender.

Science Service spares no pains or expense in the endeavor (1) to get the best possible quality of popular science writing and (2) to get it to the largest possible number of readers. If in doing this it can make both ends meet, so much the better. If not, it will do it anyway.

Through the generosity of E. W. Scripps, Science Service has been assured of such financial support as to insure its independence and permanence. Mr. Scripps's long and wide experience as a newspaper editor and proprietor had convinced him of the importance of scientific research as the foundation of the prosperity of the nation and as guide to sound thinking and living and he realized the need for an independent agency that would bring the results of research to the attention of the entire people so these could be applied to the solution of their personal, social or political problems.

Science Service is chartered as a non-profit-making institution and all receipts from articles, books, lectures and films are devoted to opening up new avenues for the diffusion of knowledge and developing promising methods of popular education. Although Science Service has a philanthropic purpose, it is conducted on business principles, with the aim of making each branch of its activities ultimately self-supporting so far as possible. All acceptable contributions are paid for and all published articles are charged for.

Science Service is under the control of a Board of Trustees composed of ten scientists and five journalists. The leading national organizations of all the sciences, the National Academy of Sciences, the National Research Council, and the American Association for the Advancement of Science, appoint three trustees each.

Science Service occupies offices in the magnificent new building of the National Academy of Sciences and the National Research Council on Potomac Park opposite the Lincoln Memorial.

This strategic situation enables the Service to keep constantly in touch with the progress of the sciences because new inventions and discoveries are promptly put on exhibition in the building, and the Council brings together investigators in the various sciences and leaders in engineering and industry from all parts of the country.

Science Service is not a governmental institution, but it is in close contact with the numerous governmental bureaus of research. It is not under the control of any clique, class or commercial interest. It is not the organ of any single scientific association. It serves all the sciences. It engages in no propaganda, unless it be called propaganda to urge the value of research and the usefulness of science.

Science Service began its work on January 1, 1921, and has now a sizable office staff with a large corps of contributors in the chief research institutions of this country and Europe.